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Notes on some species of the genus *Melanopa* (Opiliones: Sclerosomatidae: Gagrellinae) from China, with description of a new species

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Abstract. *Melanopa zhui,* a new species from Hunan Province, China, is described. *M. grandis* Roewer 1910 and *M. wangi* Zhu & Song 1999 are redescribed. The morphological characters and male genitalia of the three species are illustrated.

Keywords: Harvestmen, taxonomy, morphology, Palearctic region, Indo-Malaya region

Opilionids of the family Sclerosomatidae Simon 1879 are currently divided into subfamilies: Sclerosomatinae Simon 1879, Gagrellinae Thorell 1889, Leiobuninae Bank 1893 and Gyinae Šilhavý 1946, albeit unclearly delimited (Cokendolpher et al. 2007; Hedin et al. 2012). The genus *Melanopa* Thorell 1889 belongs to the subfamily Gagrellinae, and currently comprises 32 described species, which are mainly distributed throughout South Asia, Southeast Asia and East Asia (Roewer 1955; Suzuki 1982; Zhu & Song 1999; Kury 2012).

The genus *Melanopa* was erected by Thorell in 1889, based on the type species *M. plebeja* Thorell 1889 from Burma. With (1903) later synonymized this genus with *Gagrella* Stoliczka 1869, a decision that was rejected by Roewer in 1910 (Crawford 1992) due to the length of femora I and III being shorter than that of the body instead of longer than the body in *Gagrella*. Roewer (1955) reviewed *Melanopa*, and 33 species were recognized. He newly diagnosed the genus and provided three distinctive characters; e.g., a pseudoarticular nodule on femur II, a median spine on scute II, and the femora I and III shorter than the body.

Both *M. japonica* Roewer 1910 and *M. biseriata* Sato & Suzuki 1938 were synonymized with *Psathyropus tenuipes* L. Koch 1878 by Suzuki (1973). *Melanopa pumilio* Karsch 1881 was transferred to *Parammbogrella* Suzuki 1963 by Suzuki (1985). Suzuki (1982) and Zhu & Song (1999) each described a new species, *M. sumatrana* Suzuki 1982 and *M. wangi* Zhu & Song 1999. To date, no further detailed and thorough worldwide revisions were done except for aforementioned description and identification of species.

Previously, four *Melanopa* species have been recorded from China: *M. grandis* Roewer 1910, *M. similaris* Roewer 1955, *M. yunnanensis* Roewer 1910 and *M. wangi* Zhu & Song 1999. In this paper, *M. wangi* and *M. grandis* are redescribed and illustrated, based on the type specimens of *M. wangi* and new material of *M. grandis* collected from northeastern China. In addition, a new species is also recognized from Hunan Province, China, and is described under the name *M. zhui* new species.

METHODS

The specimens were preserved in 75% ethanol and were examined and drawn using a Leica M165c stereomicroscope equipped with a drawing tube. We studied further details using a compound Nikon YS100 microscope. The morphological terminology follows Hillyard & Sankey (1989). The terminology of genitalic structures follows Macías-Ordóñez et al. (2010) and Martens (1986). BLI follows Staręga (1972), which is abbreviated from "Beinlängenlindex" (index of leg length) and indicates the relation of the femur I length to the carapace width. Carapace width was measured between the incisions of coxae II and III, length from the anterior of carapace to the rear margin of the carapace medially. Opisthosoma width was measured at the widest point, length from anterior margin to the end medially. The cross-sectional shape of the shaft and glans refer to Martens (1978).

Specimens that we examined for this paper are deposited in the Museum of Hebei University, Baoding, China (MHBU). The following descriptions are based mostly on males; female characters, where notably different, are indicated. All measurements are given in mm. Abbreviations used in figures are as follows: Me = membrane; MS = microsetae; Mu = musculature; SD = sperm duct and Te = tendon.

TAXONOMY

Family Sclerosomatidae Simon 1879
Subfamily Gagrellinae Thorell 1889
Genus *Melanopa* Thorell 1889

Melanopa Thorell 1889:659; Roewer 1910:20; Roewer 1923:931; Roewer 1955:97; Crawford 1992:29.

Type species.—*Melanopa plebeja* Thorell 1889, by original designation.

Emended diagnosis (Palearctic species of *Melanopa* only).—Scute II with a median spine (scutes I and II each with a median spine in *M. ovata*: Sato & Suzuki 1938); only femur II with pseudoarticular nodule; male pedipalpal tibia with conspicuous ventral denticles. Penis lanceolate, shaft without sacs, the base of shaft with two large pieces of membrane; glans with an angle to the shaft in most species; glans without sensory seta; stylus short.

Composition.—33 species: *M. asperula* Roewer 1955, *M. atrata* (Stoliczka 1868), *M. cinctipes* Banks 1930, *M. dilata* Roewer 1929, *M. fragilis* (With 1903), *M. grandis* Roewer 1910, *M. guttata* Karsch 1881, *M. hansenii* (With 1903), *M. hirta* (With 1903), *M. impressata* Roewer 1955, *M. laciniipes* Roewer 1955, *M. maculipes* Banks 1930, *M. matherania* Roewer 1915, *M. nigra* Roewer 1955, *M. nigripes* Banks 1930, *M. ovata* Sato & Suzuki 1938, *M. peguana* Roewer 1955, *M. plebeja* Thorell 1889 (type species), *M. rugosa* Roewer 1955, *M. satoi* Roewer 1955, *M. scabra* Roewer 1912, *M. similaris* Roewer 1955, *M. sumatrana* Suzuki 1982, *M. thienemanni* Roewer 1931, *M. transversalis* Roewer 1912, *M. tristis* Thorell 1889, *M. trochanteralis* Roewer 1955, *M.*

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unicolor Roewer 1912, *M. varians* (With 1903), *M. vittata* Roewer 1910, *M. wangi* Zhu & Song 1999, *M. yuennanensis* Roewer 1910 and *M. zhui* new species.

Distribution.—China, Japan, Korea, Far East Russia, India, Sri Lanka, Sikkim, Nepal, Malaysia, Indonesia, Myanmar, and Vietnam.

Comments.—Male genitalia are not described for most known species of this genus, except *M. grandis* Roewer 1910, *M. satoi* Roewer 1955, *M. unicolor* Roewer 1912 and *M. wangi* Zhu & Song 1999. The male genitalia of these three species (*M. grandis*, *M. satoi*, *M. wangi*) have no alate part (sac), and these Palearctic species are distributed mainly in eastern Asia. In contrast, the male genitalia of *M. unicolor* have an alate part, and this species is found in southern Asia (see Diagnosis and Discussion).

Moreover, *M. guttata* Karsch 1881 and *M. ovata* Sato & Suzuki 1938 occur only in Japan. Although the males are unknown for either species, considering their distribution we tentatively place them amongst the Palearctic species. *Melanopa zhui* new species can no doubt also be referred to the Palearctic species-group based on its male genitalic morphology and distribution.

KEY TO PALEARCTIC SPECIES OF *MELANOPA*

1. Male (males of *M. guttata* and *M. ovata* are unknown) 2
   Female (female data of *M. satoi* not available) 5
2. Pedipalpal tibia ventrally with 3 enlarged denticles (Fig. 54; Roewer 1955: fig. 155; Suzuki 1986: fig. 42C) 3
   Pedipalpal tibia ventrally with 7 or more enlarged denticles (Figs. 9, 10, 31–32) 4
3. Proximal segment of chelicera with 3 dorsal teeth; shaft of penis with parallel sides (Figs. 51, 56) . . . *Melanopa zhui* new species
   Proximal segment of chelicera without dorsal teeth; shaft of penis with concave sides (Suzuki 1986: fig. 42B) . . . . *Melanopa satoi*
4. Shaft of penis with parallel sides, glans with tapered end (Figs. 15, 18, 19, 22) . . . . . *Melanopa grandis*
   Shaft of penis with concave sides, glans with truncated end (Figs. 33, 35, 36, 39) . . . . . *Melanopa wangi*
5. Scutes I and II each with a median spine (Sato & Suzuki 1938: fig. 3) . . . . . *Melanopa ovata*
   Scute II with a median spine 6
6. Pedipalpal femur as long as that of patella+tibia or tarsus (Sato & Suzuki 1938: 376) . . . . . *Melanopa guttata*
   Pedipalpal femur shorter than that of patella+tibia or tarsus (Table 1, 2, 3) 7
7. Proximal segment of chelicera with a ventral spur which has distal end blunt, without seta (Fig. 42) . . . . . *Melanopa wangi*
   Proximal segment of chelicera with a ventral setiferous spur (Fig. 65) 8
8. Pedipalpal tibia with many denticles ventrally and dorsally (Figs. 67, 68) . . . . . *Melanopa zhui* new species
   Pedipalpal tibia only with several denticles ventrally (Figs. 12, 13) . . . . . *Melanopa grandis*

Melanopa grandis Roewer 1910
Figs. 1–22

Melanopa grandis Roewer 1910:27; 1923:936–937; 1955:105; Suzuki 1960:25, fig. 7; 1965:355, fig. 1; 1972:65, fig. 1–3; 1973:8; 1986:31–32, fig. 40–41; Staręga 1978:208; Suzuki & Tsurusaki 1983:210; Tsurusaki 1982:12, fig. 5–7; 2006:153–154, fig. 6E–F; Tsurusaki & Sasaji 1991:18, fig. 8B; Li & Song 1993:241; Tchmeris 2000:41–45, fig. 42–53; Tsurusaki et al. 2005:52–55, fig. 2–5.

Metagagrella ussuriensis Redikorzew 1936:47–48, fig. 22–23; Roewer 1954:247; Staręga 1965:10–11; Gritsenko 1979a:33; 1979b:124–125, fig. 1–4. First synonymized with *M. grandis* by Tchmeris (2000).

Metagagrella damila Šilhavý 1976:297, fig. 1–12. First synonymized with *M. grandis* by Tsurusaki et al. (2005).

Gagrella crassitarsi Ha, Bae, Chun & Kim 2004:62, fig. 5–6. First synonymized with *M. grandis* by Tsurusaki et al. (2005).

Type specimens.—*M. grandis:* JAPAN: Holotype female, Tokyo (Zoologiseches Institut und Museum, Hamburg), not examined.

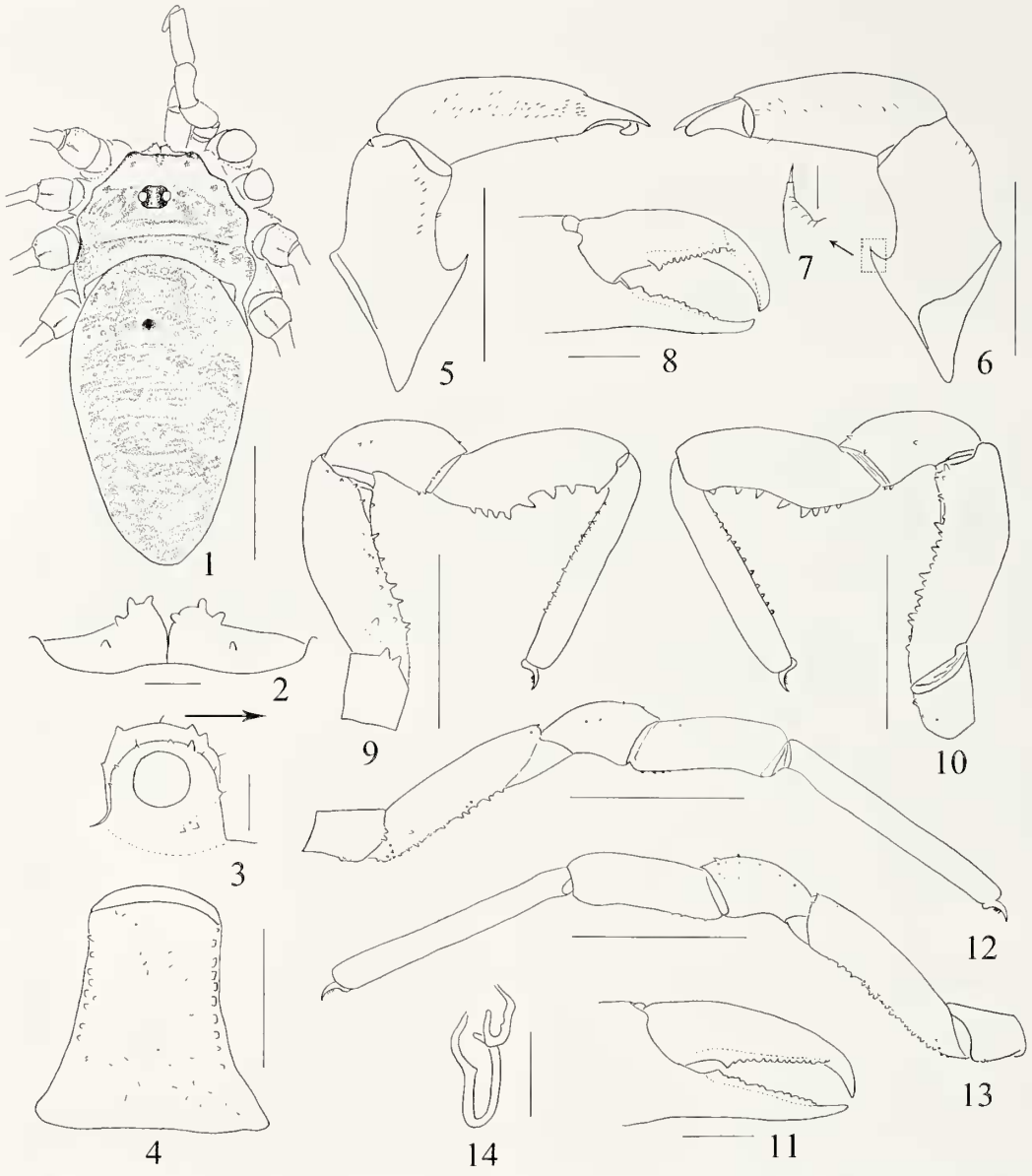
Material examined.—CHINA: *Jilin Province*: 3 ♂, 4 ♀, Huadian City, Jiapigou Town, 580 m, 42°53′N, 127°34′E, 7 August 2011, C. Zhang (MHBU); 1 ♂, 2 ♀, Antu County, Erdaobaihe Town, 865 m, 42°19′N, 128°07′E, 12 August 2011, B.S. Zhang and H.M. Yu (MHBU); *Liaoning Province*: 3 ♂, 6 ♀, Xinbin County, Nanzamu Town, 210 m, 41°56′N, 124°24′E, 22 August 2011, C. Zhang (MHBU).

Diagnosis.—*Melanopa grandis* can be recognized by the following characters: 1) male pedipalpal tibia ventrally with 7–8 enlarged denticles; 2) shaft of penis with nearly parallel sides, flattened dorsally and arched ventrally; 3) glans arched dorsally and ventrally.

Redescription.—*Coloration:* Dorsum with brown background. Preocular region of propeltidium with a large white fleck, each side of ocular region with rusty brown flecks covered with a few whitish dots, post-optic region with a triangular dark brown fleck. Ocularium brown, with blackish eye rings and a pale dorsal band. Meso- and metapeltidium rusty brown. Metapeltidium with imperfect transverse rows of white spots medially and darker patches laterally. Opisthosomal scute with obscure dark brown saddle, darker anteriorly and posteriorly, lighter between. Many white spots on the saddle surface. Lateral saddle and free tergites brown to dark brown and with numerous white spots.

Venter: Coxae I–IV brown. Genital operculum rusty yellow. Sternites rusty yellow to dark brown at middle, with light brown patches laterally. Chelicerae yellow. Pedipalpus yellowish brown, femur and patella blackish brown, tarsus yellow. Legs yellowish brown to dark brown, patella blackish brown and apical tibiae pale yellow.

Dorsum (Fig. 1)*:* Entire body leathery, dorsum covered with rather fine granules. Carapace without any denticles. Supracheliceral laminae with four tubercles on each lamina (Fig. 2). Ozopores small and visible from above. Ocularium average-sized (about 1/6 of width and 2/7 of length of carapace) with a



Figures 1–14.—*Melanopa grandis* Roewer 1910, from Jiapigou Town (42°53′N, 127°34′E): 1–10: male; 11–14: female. 1. Dorsal aspect of body; 2. Dorsal aspect of supracheliceral laminae; 3. Lateral aspect of ocularium; 4. Ventral aspect of genital operculum; 5. Medial aspect of left chelicera; 6. Ectal aspect of left chelicera; 7. Ectal aspect of left ventral setiferous spur; 8. Frontal aspect of left fingers; 9. Medial aspect of left pedipalpus; 10. Ectal aspect of left pedipalpus; 11. Medial aspect of left pedipalpus; 12. Ectal aspect of left pedipalpus; 13. Frontal aspect of left fingers; 14. Seminal receptacle. Scale = 2 mm (1); 1 mm (4–6, 9–10, 12–13); 0.2 mm (2, 3, 8, 11); 0.1 mm (7); 0.05 mm (14).

medial groove and rows of tubercles on the carinae and two tubercles beneath each eye (Fig. 3). Scute II with a strong spine, remaining opisthosomal tergites smooth.

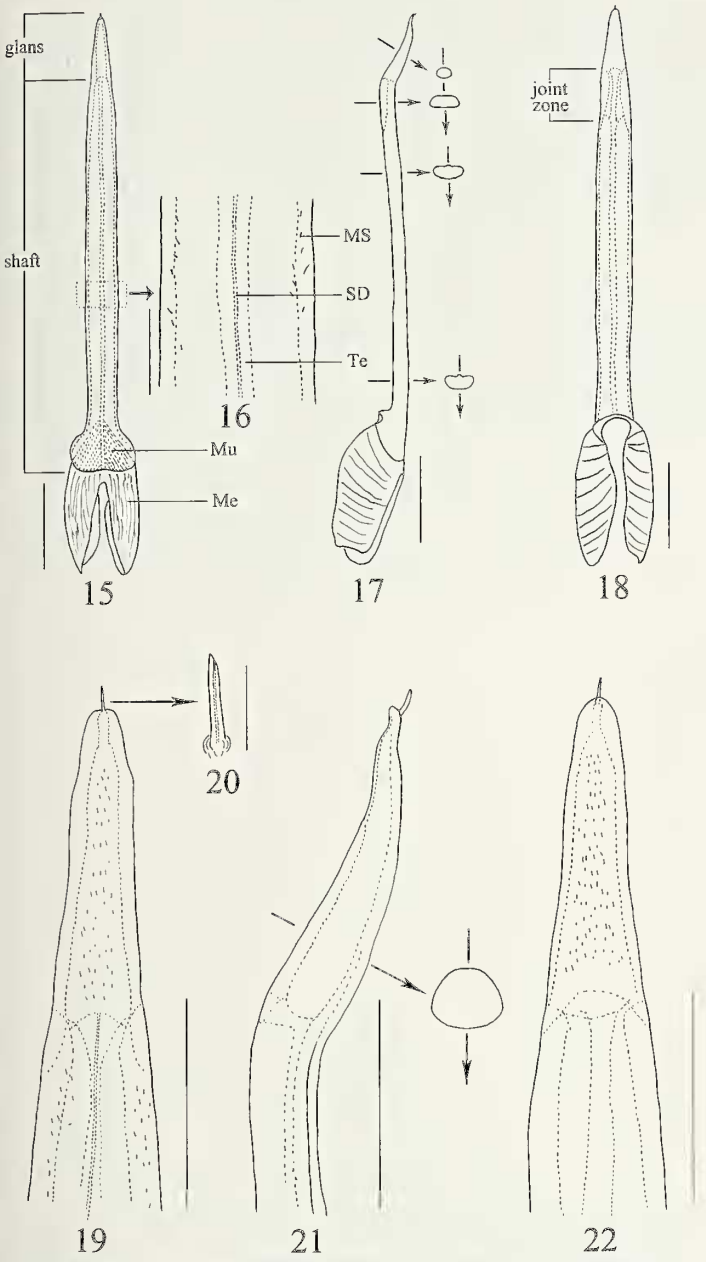
Venter: Surface of all coxae roughly granular, all coxae anteriorly and coxae I and IV posteriorly with a row of subquadratic marginal tubercles, lateral row of similar tubercles on each side of genital operculum. Genital operculum (Fig. 4) almost trapezioid, surface with sparse setae. Opisthosomal sternites smooth, with sparse setae.

Chelicera (Figs. 5–8)*:* Proximal segment with a ventral setiferous spur (Fig. 7), with only a few dorsal setae and two ventral setae, also and a row of medial setae. Second segment with setae on the frontal surface, and numerous short medial setae. Inner edges of fingers toothed as illustrated (Fig. 8): teeth on the fingers serrated, the basal tooth is the largest.

Pedipalpus (Figs. 9, 10)*:* Trochanter with two conspicuous distomesal and ventral denticles. Femur ventrally with numerous dense denticles, on the medial basal side with one denticle, on the same distal margin having a few denticles. Patella with two medial and one ectal denticles, distal margin with a few denticles. Tibia swollen at base, ventrally with a row of eight enlarged denticles. Tarsus ventrally with two longitudinal rows of microdenticles, medial dentition longer than ectal one. Remainder of each pedipalpal segment only with hair. Claw with teeth.

Legs: All trochanters prolaterally and retrolaterally with many denticles. Femur, patella and tibia with rows of teeth, the rest of each segment only with rows of setae. Nodule formula 0/1/0/0.

Penis (Figs. 15–22)*:* Shaft with nearly parallel sides, abruptly widened basally, gradually narrower in joint zone



Figures 15–22.—*Melanopa grandis* Roewer 1910, male from Jiapigou Town (42°53′N, 127°34′E). 15. Ventral aspect of penis; 16. Ventral aspect of shaft (part); 17. Lateral aspect of penis; 18. Dorsal aspect of penis; 19. Ventral aspect of glans; 20. Ventral aspect of stylus; 21. Lateral aspect of glans; 22. Dorsal aspect of glans. Scale = 1 mm (15, 17–18); 0.5 mm (19, 21–22); 0.2 mm (16); 0.05 mm (20).

and extending to a finger-shaped glans. Shaft flattened dorsally and arched ventrally, medial shaft dorsally bulgy and ventral surface with sparse microsetae along both sides of the shaft. In contrast, joint zone flattened ventrally and dorsal surface tapered into the glans, both sides of joint zone with more microsetae than ventral surface. Sperm duct conspicuously visible in the joint zone. Musculature limited to basal shaft and membranes. Glans slightly bent, holding at about 160° with shaft. Glans widest at base, gradually narrower toward blunt end. Dorsal surface arched strongly and ventral slightly, both central surface with many microsetae. Stylus short, cylindrical, inserted ventrally near apex of glans and with a bevel apex.

Female (Figs.11–14)*:* Similar to male but much larger, and abdomen wide. Cheliceral fingers longer than the male, inner edges toothed as illustrated (Fig. 11). Pedipalpal tibia normal, ventrally with reduced denticles at base, tarsus without any denticles and micro-denticles (Figs. 12, 13).

Seminal receptacle (Fig. 14)*:* Between segments two and three, consisting of a small anterior and a large posterior ampulla.

Measurements: Male (female): body 7.10 (7.90) long. Carapace 1.90 (2.15) long, 3.00 (2.80) wide. Opisthosoma 5.20 (5.75) long, 3.15 (3.90) wide. BLI 2.08 (2.05). Eye tubercle 0.42 (0.40) long, 0.56 (0.53) wide, 0.40 (0.40) high. Penis shaft 4.45 long, 0.75 wide at base, glans 0.41 long, stylus 0.06 long. Measurements of left pedipalpus and right legs as in Table 1.

Variation.—Size range of male (female). Body length 7.00–7.50 (7.90–9.00). Carapace length 1.85–2.13 (2.15–2.25), width 3.15–3.63 (2.80–3.55); opisthosoma length 5.25–5.38 (5.75–6.63), width 3.00–3.33 (3.90–4.38).

Habitat.—The specimens were collected with an entomological net or picked from low foliage and tree trunks in the forest.

Distribution.—China, Russia, Japan and Korea.

Melanopa wangi Zhu & Song 1999
(Figs. 23–46)

Melanopa wangi Zhu & Song 1999:160, 162, fig. 2.

Type material.—CHINA: *Hunan Province:* Holotype male, Zhangjiajie National Forest Park (29°08′N, 111°25′E), Zhangjiajie City, 20 August 1990, M.S. Zhu (MHBU), examined. Paratypes: 1 ♂, 1 ♀, collected with holotype (MHBU), examined.

Diagnosis.—This species is recognized by the following characters: 1) male pedipalpal tibia ventrally with many denticles; 2) shaft of penis with concave sides, flattened ventrally, and arched dorsally; and 3) glans with truncated end, flattened ventrally and arched dorsally.

Redescription.—*Coloration:* dorsum with rusty brown background. Propeltidium with many dark brown markings around ocular region. Ocularium rusty brown, with blackish eye rings and a pale dorsal band. Meso- and metapeltidium each with a transverse row of blackish brown streak. Saddle on opisthosomal scute imperfect, only median part of scutes I and II blackish-brown. Remainder scutes and free tergites with blackish brown dots and cross stripes.

Venter: Coxae I–IV, genital operculum and sternites rusty brown, sternites with many black flecks. Proximal segment of chelicerae rusty yellow, second segment rusty brown and with some black flecks frontally. Pedipalpus yellowish brown, femur and patella blackish brown, tibia and tarsus with many blackish flecks. Legs rusty brown, trochanter, and femur blackish brown.

Dorsum (Fig. 23)*:* Entire body leathery, dorsum covered with rather fine granules. Carapace without any denticles. Supracheliceral laminae with many tubercles on each lamina (Fig. 24). Ozopores small and visible from above. Ocularium average-sized (about 1/6 of width and 1/4 length of carapace), rounded dorsally, canaliculate, almost smooth, only with sparse hairs (Fig. 25). Scute II with a strong spine, remaining opisthosomal tergites smooth.

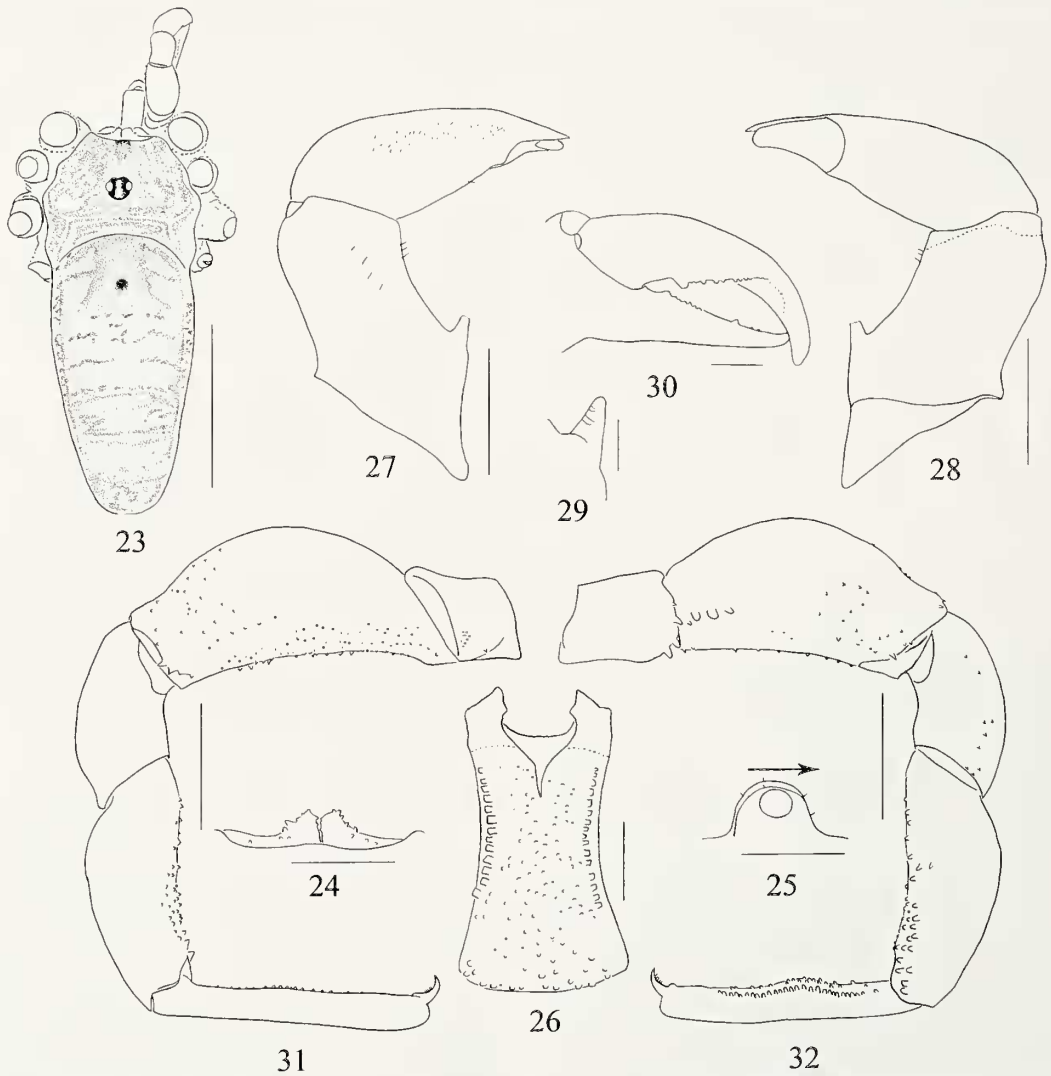
Table 1.—Pedipalpus and legs measurements of the male (female) of *Melanopa grandis*.

	Trochanter	Femur	Patella	Tibia	Metatarsus	Tarsus	Total
Pedipalpus	0.50(0.40)	1.15(1.00)	0.84(0.70)	0.95(0.73)		1.35(1.46)	4.79(4.29)
Leg I	0.60(0.65)	6.25(5.75)	1.50(1.50)	5.90(5.00)	7.50(6.75)	11.25(9.50)	33.00(29.15)
Leg II	0.60(0.65)	11.50(10.75)	1.50(1.50)	11.25(10.50)	11.90(10.75)	21.00(21.50)	57.75(55.65)
Leg III	0.60(0.65)	6.25(5.75)	1.50(1.50)	5.50(4.75)	8.00(7.25)	11.00(9.25)	32.85(29.15)
Leg IV	0.60(0.65)	9.25(6.40)	1.50(1.50)	7.65(5.25)	11.50(8.10)	14.90(9.10)	45.40(31.00)

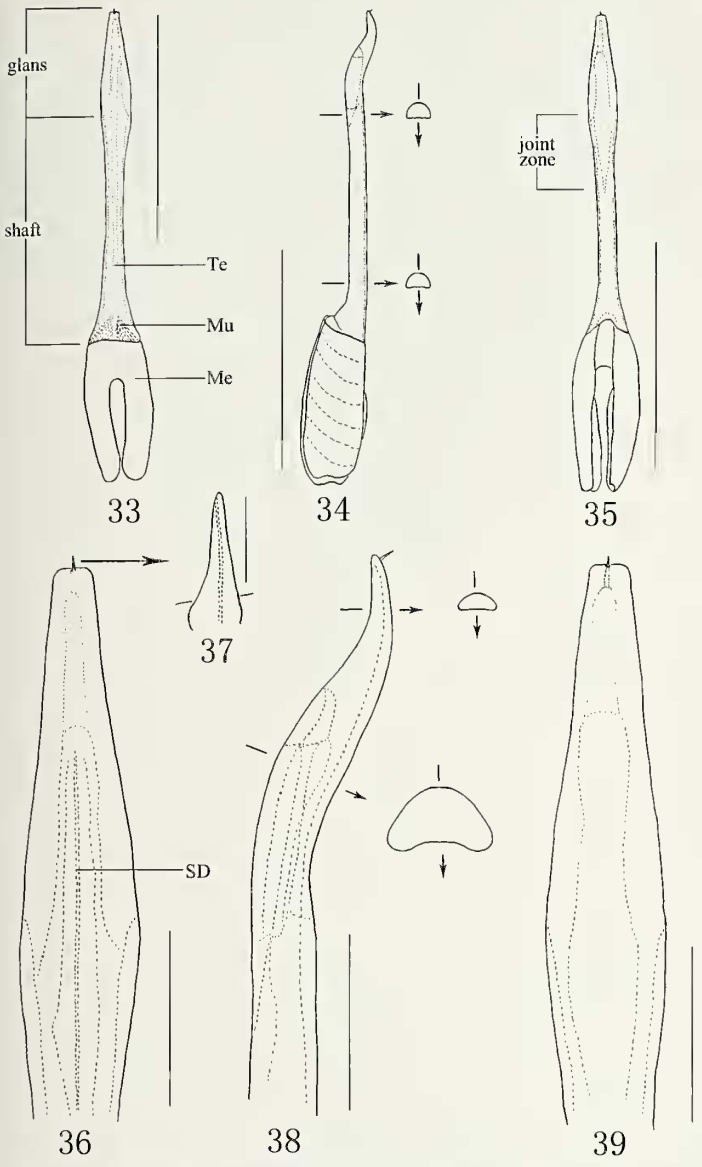
Venter: Surface of all coxae roughly granular, all coxae anteriorly and coxae I and IV posteriorly with a row of subquadratic marginal tubercles, a lateral row of similar tubercles on each side of genital operculum. Genital operculum (Fig. 26) surface with many granules, anterior margin with a wide median cleft, lateral margin somewhat concave, almost twice as long as posterior margin. Opisthosomal sternites smooth, with sparse setae.

Chelicera (Figs. 27–29)*:* Proximal segment with a ventral spur (Fig. 29), distal end blunt, without seta, with only a few dorsal and ventral setae, and a row of medial setae. Second segment with setae on the frontal surface and numerous short medial setae. Inner edges of fingers toothed as illustrated (Fig. 30): discontinuous teeth on the fingers serrated, fixed finger more conspicuous than moveable finger, the basal tooth largest.

Pedipalpus (Figs. 31, 32)*:* Trochanter with four conspicuous distomesal and a few ventral denticles, femur strongly swollen in medial part, with numerous dense denticles except disto-dorsal side, with four conspicuous denticles on medial basal



Figures 23–32.—*Melanopa wangi* Zhu & Song 1999, male (holotype) from Zhangjiajie City (29°08′N, 111°25′E). 23. Dorsal aspect of body; 24. Dorsal aspect of supracheliceral laminae; 25. Lateral aspect of ocularium; 26. Ventral aspect of genital operculum; 27. Medial aspect of left chelicera; 28. Ectal aspect of left chelicera; 29. Ectal aspect of right ventral spur; 30. Frontal aspect of left fingers; 31. Ectal aspect of left pedipalpus; 32. Medial aspect of left pedipalpus. Scale = 5 mm (23); 1 mm (24–28, 31–32); 0.2 mm (29–30).



Figures 33–39.—*Melanopa wangi* Zhu & Song 1999, male (holotype) from Zhangjiajie City (29°08′N, 111°25′E). 33. Ventral aspect of penis; 34. Lateral aspect of penis; 35. Dorsal aspect of penis; 36. Ventral aspect of glans; 37. Ventral aspect of stylus; 38. Lateral aspect of glans; 39. Dorsal aspect of glans. Scale = 5 mm (33–35); 1 mm (36, 38–39); 0.05 mm (37).

side. Patella with a few medial denticles. Tibia swollen at base, ventrally with many conspicuous denticles. Tarsus somewhat swollen ventrally in middle part, ventrally with a longitudinal row of micro-denticles as well as many scattered similar denticles. Remainder of each pedipalpal segment only with hair. Claw with teeth.

Legs: All trochanters prolaterally and retrolaterally with many denticles. Femur, patella and tibia with rows of teeth, rest of each segment only with rows of setae. Nodule formula 0/4/0/0.

Penis (Figs. 33–39)*:* Sides of shaft concave, widened distally and proximally. Shaft flattened ventrally and arched dorsally. Both sides of joint zone and basal glans with many microsetae. Sperm duct conspicuously visible in the joint zone. Musculature limited to basal shaft and membranes. Glans slightly bent, holding at about 160° with shaft, reflexed distally. Glans widest at base, gradually narrower toward truncated end, dorsal surface arched and ventral flattened. Stylus short, conical from ventral view, inserted ventrally near apex of glans.

Female (Figs. 40–46)*:* Similar to male but body slightly shorter and wider. Anterior margin of genital operculum (Fig. 41) with a wide median cleft. Inner edges of cheliceral fingers toothed as illustrated (Fig. 43), both fixed finger and moveable finger with continuous teeth. Pedipalpus normal, tarsus without any denticles (Figs. 44, 45).

Seminal receptacle (Fig. 46)*:* Between segments two and three, consisting of a small and a large ampullae.

Measurements: Male (female): body 11.75 (7.90) long. Carapaee 3.00 (2.90) long, 4.75 (4.55) wide. Opisthosoma 8.75 (5.90) long, 3.90 (5.25) wide. BLI 2.11 (2.03). Eye tubercle 0.70 (0.60) long, 0.78 (0.70) wide, 0.55 (0.50) high. Penis 7.50 long: shaft 5.25 long, 1.16 wide at base; glans 2.25 long, 0.65 wide at base; stylus 0.09 long. Measurements of left pedipalpus and right legs as in Table 2.

Habitat.—Unknown.

Distribution.—China.

Melanopa zhui new species
(Figs. 47–69)

Type material.—CHINA: *Hunan Province*, Holotype male, Zhangjiajie City, Zhangjiajie National Forest Park, 29°08′N, 111°25′E, 20 August 1990, M.S. Zhu (MHBU). Paratype: 1 ♀, collected with holotype (MHBU).

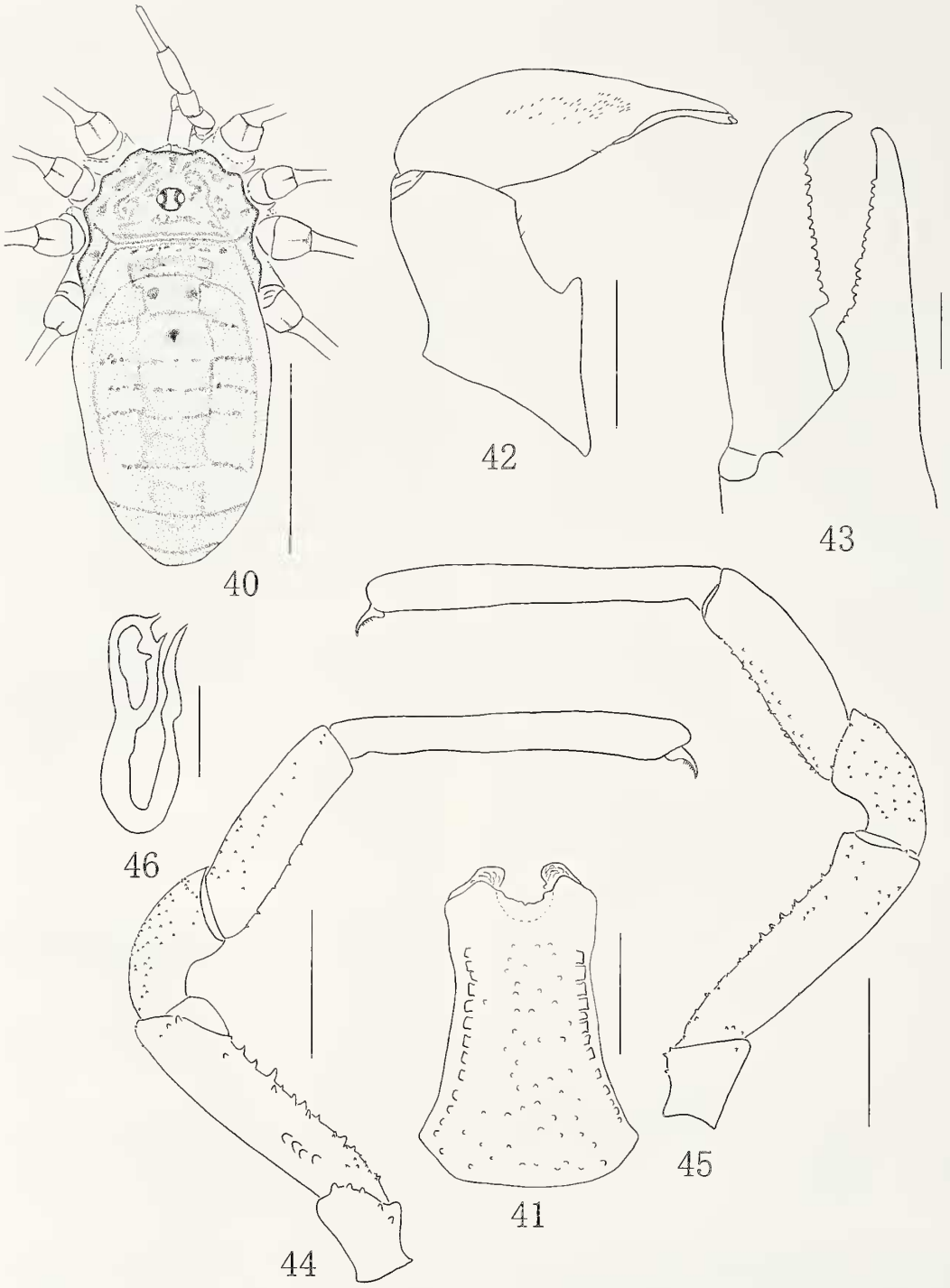
Etymology.—The specific name is a patronym in honor of the late Professor Mingsheng Zhu (1950–2010), a well known arachnologist in China.

Diagnosis.—Recognized by the following characters: 1) male pedipalpal tibia distally with three ventral denticles; 2) Shaft flattened ventrally, both sides of dorsal surface bulgy in form of the shallow U-shaped cross section and 3) glans not bent, base dorsally with median pit.

Description.—*Coloration:* dorsum with rusty yellow background. Propeltidium with many brown markings around ocular region. Ocularium yellow, with blackish eye rings and a pale dorsal band. Meso- and metapeltidium rusty brown with two lateral yellow flecks. Saddle on opisthosomal scute inconspicuous, only median part of scutes I–II and V blackish

Table 2.—Pedipalpus and legs measurements of the male (female) of *Melanopa wangi.*

	Trochanter	Femur	Patella	Tibia	Metatarsus	Tarsus	Total
Pedipalpus	0.85(0.55)	2.20(1.60)	1.50(1.08)	1.65(1.36)		2.10(2.60)	8.30(7.19)
Leg I	1.25(1.00)	10.00(9.25)	2.50(2.25)	9.00(8.00)	12.75(11.50)	14.00(14.50)	49.50(46.50)
Leg II	1.25(1.00)	21.00(17.25)	2.50(2.25)	21.00(17.50)	21.75(19.50)	42.50(40.00)	110.00(97.50)
Leg III	1.25(1.00)	9.25(8.50)	2.50(2.25)	9.25(7.25)	12.75(10.75)	15.50(14.00)	50.50(43.75)
Leg IV	1.25(1.00)	13.75(12.25)	2.50(2.25)	12.00(10.25)	19.75(16.25)	20.25(19.75)	69.50(62.00)

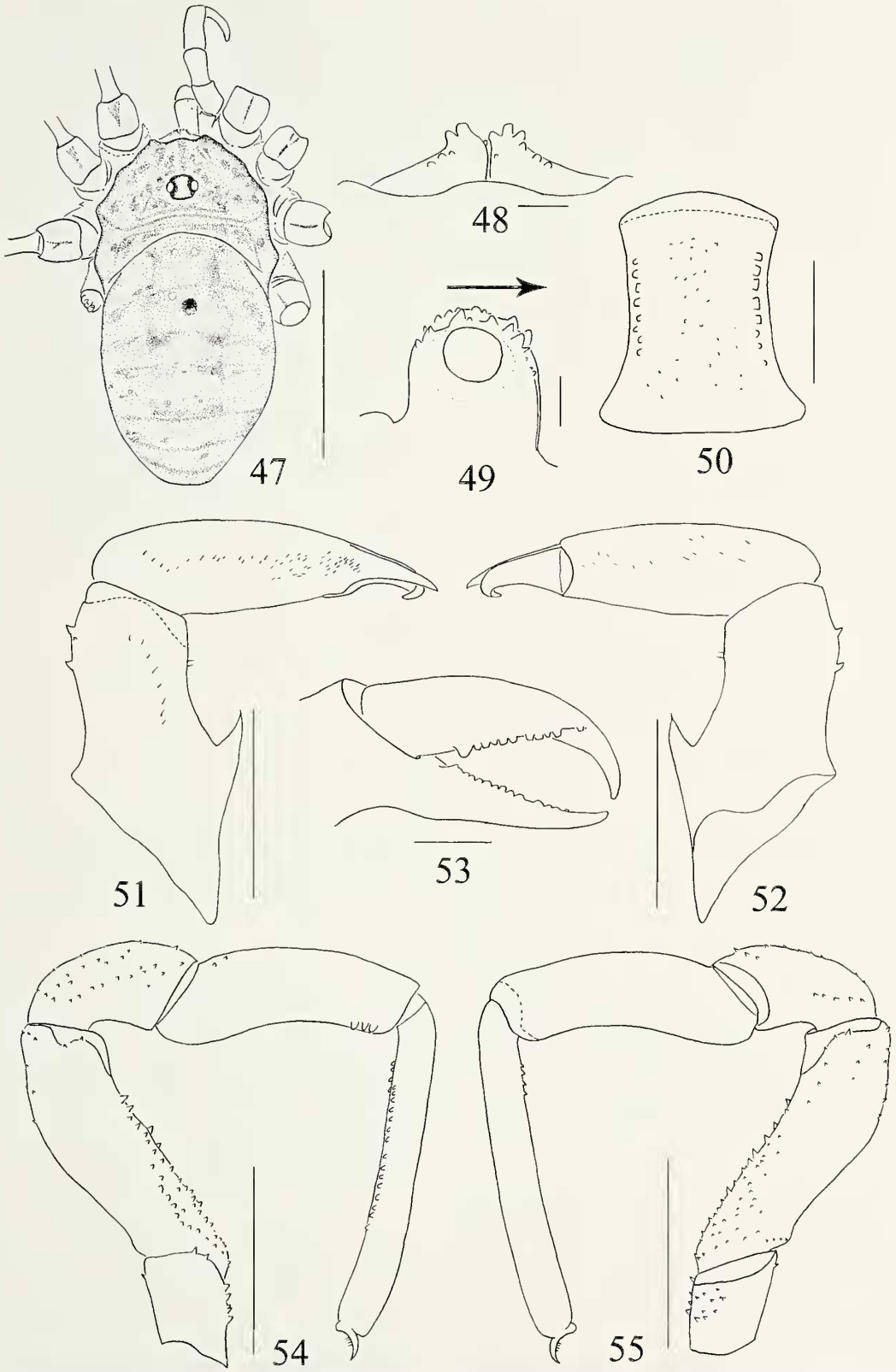


Figures 40–46.—*Melanopa wangi* Zhu & Song 1999, female (paratype) from Zhangjiajie City (29°08′N, 111°25′E). 40. Dorsal aspect of body; 41. Ventral aspect of genital operculum; 42. Medial aspect of left chelicera; 43. Frontal aspect of left fingers; 44. Ectal aspect of left pedipalpus; 45. Medial aspect of left pedipalpus; 46. Seminal receptacle. Scale = 5 mm (40); 1 mm (41–42, 44–45); 0.2 mm (43); 0.05 mm (46).

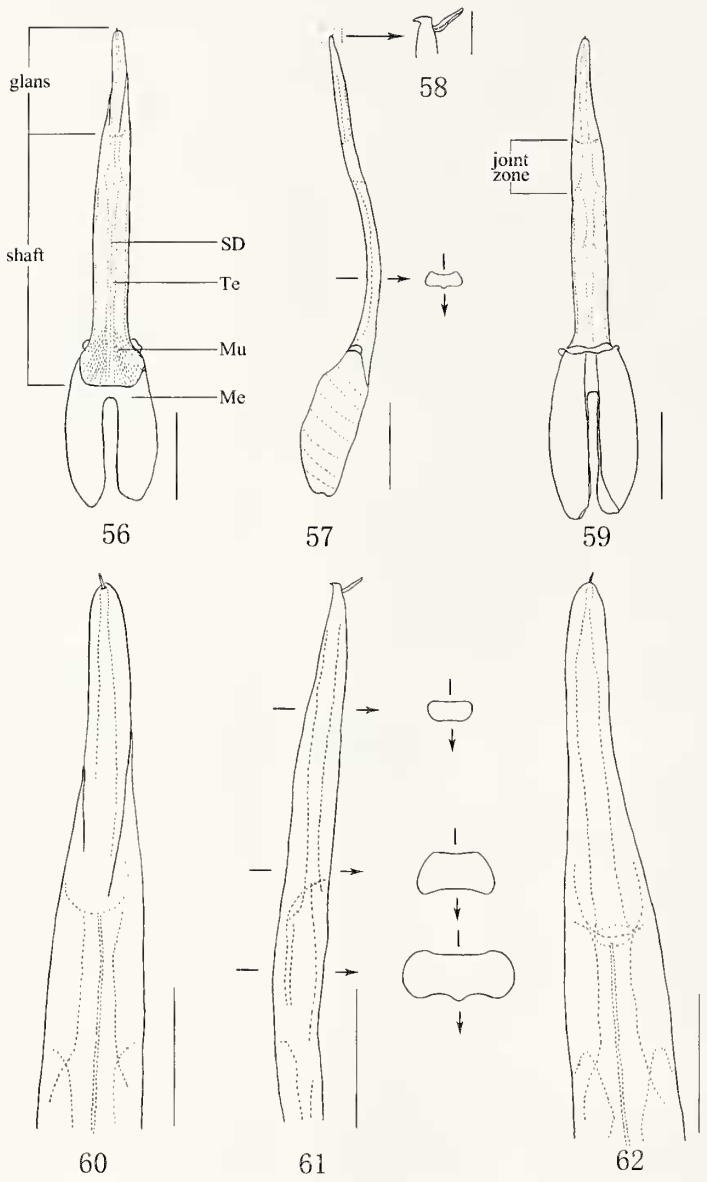
brown. Remainder scutes and free tergites with dark brown dots and cross stripes.

Venter: Coxae I–IV and genital operculum dark rusty brown, sternites rusty yellow and with many dark brown flecks in median section. Chelicerae yellow, proximal segment with dark brown patches dorsally and ventrally, second segment with the same color stripes medially and ectally. Pedipalpus: trochanter, femur, patella and basal tibia brown, remaining part of tibia and tarsus yellow. Legs rusty brown, trochanter yellow dorsally and dark brown ventrally, metatarsus and tarsus somewhat lighter.

Dorsum (Fig. 47): Entire body leathery, dorsum covered with rather fine granules. Carapace without any denticles. Supracheliceral laminae with a few tubercles on each lamina (Fig. 48). Ozopores small and visible from above. Ocularium average-sized (about 1/6 of width and 1/3 of length of



Figures 47–55.—*Melanopa zhui* new species, male (holotype) from Zhangjiajie City (29°08′N, 111°25′E). 47. Dorsal aspect of body; 48. Dorsal aspect of supracheliceral laminae; 49. Lateral aspect of ocularium; 50. Ventral aspect of genital operculum; 51. Medial aspect of left chelicera; 52. Ectal aspect of left chelicera; 53. Frontal aspeet of left fingers; 54. Ectal aspect of left pedipalpus; 55. Medial aspect of left pedipalpus. Scale = 5 mm (47); 1 mm (50–52, 54–55); 0.2 mm (48–49, 53).



Figures 56–62.—*Melanopa zhui* new species, male (holotype) from Zhangjiajie City (29°08′N, 111°25′E). 56. Ventral aspect of penis; 57. Lateral aspect of penis; 58. Lateral aspect of distal glans; 59. Dorsal aspect of penis; 60. Ventral aspect of glans; 61. Lateral aspect of glans; 62. Dorsal aspect of glans. Scale = 1 mm (56–57, 59); 0.5 mm (60–62); 0.1 mm (58).

carapace), rounded dorsally, canaliculate, with a few tubercles on the carinae (Fig. 49). Scute II with a strong spine, remaining opisthosomal tergites smooth.

Venter: Surface of all coxae roughly granular, all coxae anteriorly and coxae I and IV posteriorly with a row of subquadratic marginal tubercles, a lateral row of similar tubercles on each side of genital operculum. Genital operculum (Fig. 50) surface with sparse granules, anterior margin convex, lateral margin slightly concave, almost with the same length as posterior margin. Opisthosomal sternites smooth, with sparse setae.

Chelicera (Figs. 51–53)*:* Proximal segment with a ventral setiferous spur and three dorsal teeth. Second segment with setae on the frontal surface, and numerous short medial setae. Inner edges of fingers toothed as illustrated (Fig. 53): discontinuous teeth on the fingers serrated, the basal tooth largest.

Pedipalpus (Figs. 54, 55)*:* Trochanter with two conspicuous distomesal and many ventral denticles. Femur ventrally with numerous dense denticles. Patella with many denticles except for ventral side. Tibia slightly swollen at base, dorsally with two basal denticles, distally with three ventral denticles. Tarsus ventrally with a longitudinal row of micro-denticles just lateral of these denticles, with another row of four micro-denticles basally. Remainder of each pedipalpal segment only with hair. Claw with teeth.

Legs: All trochanters prolaterally and retrolaterally with many denticles. Femur, patella, and tibia with rows of teeth, the rest of each segment only with rows of setae. Nodule formula 0/2/0/0.

Penis (Figs. 56–62)*:* Shaft short, with nearly parallel sides, basal part abruptly widened. Shaft flattened ventrally, both sides of dorsal surface bulgy in form of the shallow U-shaped cross section. Joint zone flattened dorsally and ventrally, ventral surface medially bulgy. Sperm duct conspicuously visible in the joint zone. Musculature limited to basal shaft and membranes. Glans not bent, base dorsally with median pit. Dorsal surface of glans widest at base, ventral base as long as the end of glans, flattened dorsally and ventrally. End of glans with a dorsal projection, some rather beak-like from lateral view. Stylus short, cylindrical, inserted ventrally near apex of glans and with a bent base from lateral view.

Female (Figs. 63–69)*:* Similar to male and about the same size. Anterior margin of genital operculum (Fig. 64) with a wide median cleft. Inner edges of cheliceral fingers toothed as illustrated (Fig. 66), both fixed finger and moveable finger with continuous teeth. Pedipalpus normal, tibia with many denticles dorsally and ventrally, tarsus without any denticles (Figs. 67, 68).

Seminal receptacle (Fig. 69)*:* Between segments two and three, consisting of a small anterior and a large posterior ampullae.

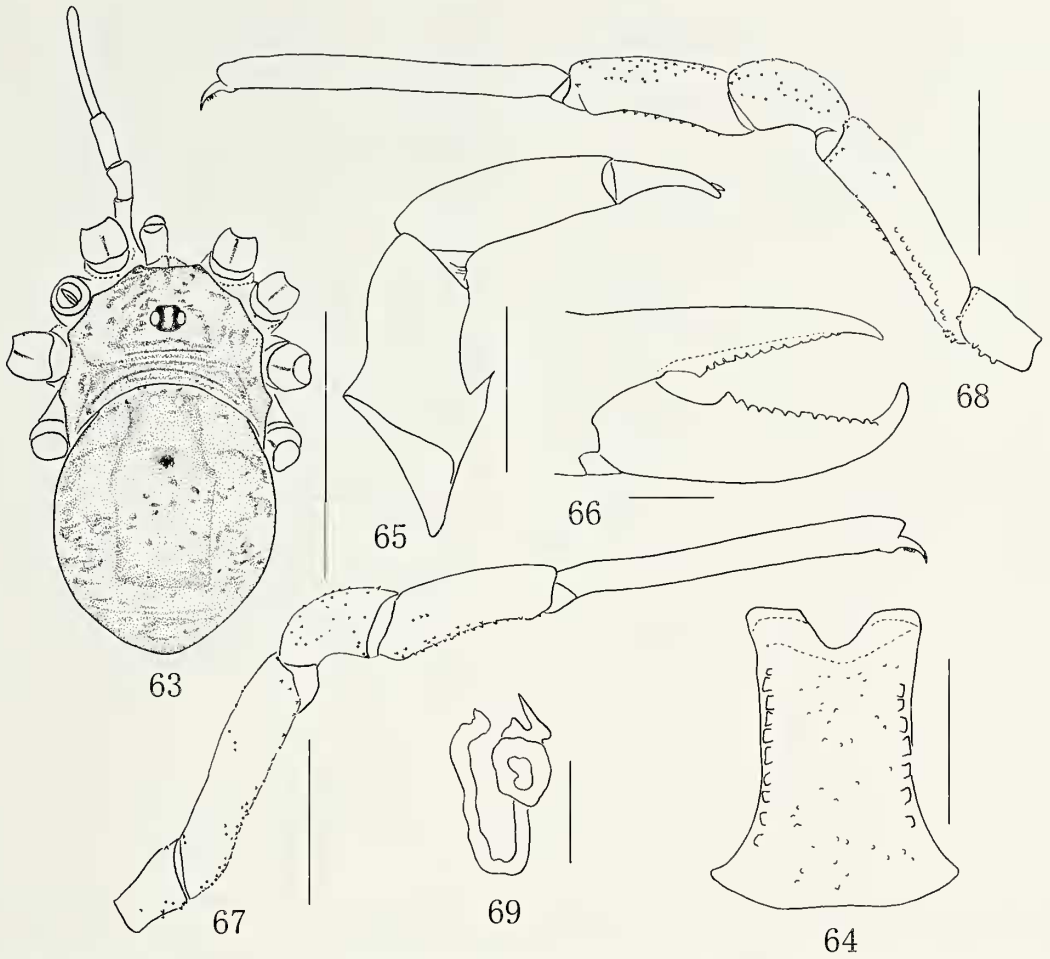
Measurements: Male (female): body 7.13 (7.50) long. Carapace 1.88 (2.00) long, 3.70 (3.63) wide. Opisthosoma 5.25 (5.50) long, 3.58 (4.25) wide. BLI 2.23 (2.18). Eye tubercle 0.48 (0.50) long, 0.68 (0.65) wide, 0.55 (0.50) high. Penis 4.18 long, shaft 3.00 long, 0.93 wide at base; glans 1.18 long; stylus 0.09 long. Measurements of left pedipalpus and right legs as in Table 3.

Habitat.—Unknown.

Distribution.—China.

DISCUSSION

Roewer's typological classification of Gagrellinae has been rather chaotic (Crawford 1992; Tourinho & Kury 2001; Klimeš 2006; Cokendolpher et al. 2007; Taylor 2009; Hedin et al. 2012) and almost the whole classification system of Roewer is artificial (Tourinho 2007; Giribet et al. 2012; Hedin et al. 2012). Roewer (1910, 1923, 1955) defined *Melanopa* by external characters such as only femur II with one pseudoarticular nodule, scute II with one median spine or scutes I–II each with one median spine, ocularium with or without tubercles, and femora I and III shorter than the body. However, he ignored the male genitalia (penis), which can be very important for harvestman classification, and his system is



Figures 63–69.—*Melanopa zhui* new species, female (paratype) from Zhangjiajie City (29°08′N, 111°25′E). 63. Dorsal aspect of body; 64. Ventral aspect of genital operculum; 65. Ectal aspect of right chelicera; 66. Frontal aspect of right fingers; 67. Ectal aspect of right pedipalpus; 68. Medial aspect of right pedipalpus; 69. Seminal receptacle. Scale = 5 mm (63); 1 mm (64–65, 67–68); 0.2 mm (66); 0.05 mm (69).

unlikely to be phylogenetically accurate (Tourinho & Kury 2001; Hedin et al. 2012).

The external characters mentioned above are often highly variable. Foremost among the characters to delimit the genus has been the number of pseudoarticular nodules in the femora of the legs (Taylor 2009); however, the number of nodules is inconsistent (Suzuki 1973; Martens 1987; Tourinho-Davis 2004; Klimeš 2006), and is not suitable to define *Melanopa*. Other variable characters used to define *Melanopa* are the relative length of the legs with respect to the body, the armature of the scutae or the ocularium. It is evident that when the genus *Melanopa* is based on these characters it tends to conceal natural phylogenetie patterns. Comparing the penis of *M. unicolor* Roewer 1912 with that of *M. grandis* Roewer 1910 and *M. satoi* Roewer 1955 (the penis of *M. unicolor* with alate part, while that of *M. grandis* and *M. satoi* without alate part, cf. Suzuki 1966:115–116, fig. 1; 1986:31–33, fig. 40, 42) demonstrates the disparity in this genus.

In addition, by not considering penis morphology, Roewer also failed to take biogeography into account. Recent research has shown that "geography is better than taxonomy in predicting phylogeny" in sclerosomatid harvestmen based on molecular data (Hedin et al. 2012). The limited dispersal ability of Opiliones makes many harvestmen groups prime candidates for biogeographic studies (e.g., Giribet & Kury 2007:77–78).

Although we have not examined most species of *Melanopa*, including the type species, and we have not carried out a full systematic revision combining external and genitalic characters, we are able to make some preliminary observations regarding this genus. On the basis of biogeography, we tentatively suggest dividing the genus into two groups: one including five species occurring in the Palearctic region, the other including 27 species recorded from the Indo-Malaya region (Table 4).

The five previously described species in the Palearctic region are *M. grandis*, *M. guttata* Karsch 1881, *M. ovata* Sato & Suzuki 1938, *M. satoi,* and *M. wangi* Zhu & Song 1999. *Melanopa guttata*, *M. ovata,* and *M. satoi* are distributed in Japan, and *M. wangi* is so far known only from Hunan Province, China. *Melanopa grandis* is widely distributed throughout Japan, the Korean peninsula and northern China. Additionally, two other species found in Yunnan Province, southern China, *M. yuennanensis* Roewer 1910 and *M. similaris* Roewer 1955, are included in the Indo-Malayan group.

The five Palearctic species show great similarity to each other in external morphology; e.g., scute II with a median

Table 3.—Pedipalpus and legs measurements of the male (female) of *Melanopa zhui*.

	Trochanter	Femur	Patella	Tibia	Metatarsus	Tarsus	Total
Pedipalpus	0.45(0.50)	1.33(1.25)	0.90(0.75)	1.10(0.95)		1.80(2.00)	5.58(5.45)
Leg I	0.75(0.75)	8.25(7.90)	2.00(1.75)	6.40(6.00)	7.90(7.90)	11.50(12.50)	36.80(36.80)
Leg II	0.75(0.75)	15.25(14.00)	2.00(1.75)	14.50(13.25)	12.60(13.75)	28.00(25.50)	73.10(69.00)
Leg III	0.75(0.75)	8.10(7.75)	2.00(1.75)	6.25(5.75)	8.25(8.25)	6.75(11.25)	32.10(35.50)
Leg IV	0.75(0.75)	11.50(11.25)	2.00(1.75)	8.50(7.75)	12.50(12.50)	14.50(14.75)	49.75(48.75)

spine (scutes I and II each with a median spine in *M. ovata*); femur II with a single pseudoarticular nodule; and pedipalpal tibia with conspicuous ventral denticles in the male. With the exception of *M. guttata* and *M. ovata* (known only from female specimens), the remaining three species (*M. grandis*, *M. satoi* and *M. wangi*) possess similar penes; e.g., penis simple: shaft without a dorsal sheath, ventral lamella, pocket, sacs or ventro-basal opening, base of shaft with two large pieces of membrane; joint zone of shaft and glans inconspicuous; glans without sensory seta; and the stylus short.

Although *M. zhui* is placed with the Palearctic species, there are still some differences between them. *Melanopa zhui* can be distinguished from *M. ovata* by scute I without a median spine, the pedipalpal patella and tibia with more denticles, ocularium with more tubercles (Sato & Suzuki 1938:376–379, fig. 4); the description of *M. guttata* provided by Roewer (1923, 1955) was brief and the figure very schematic, and it only can be distinguished from *M. zhui* by the color of body (Roewer 1923:938; Roewer 1955:105, fig. 154).

Comparing *Melanopa zhui* with the other three species with known males, the new species can be distinguished by having three ventral denticles distally on the pedipalpal tibia of the male, compared to a row of 7–8 ventral denticles in *M. grandis*, many ventral denticles in *M. wangi* and three almost evenly distributed ventral denticles in *M. satoi* (Roewer 1955:105, fig. 155; Suzuki 1986:33, fig. 42C). The most

Table 4.—Geographical distribution of the species of *Melanopa*.

No.		Species	Distribution	References
Palearctic region	1	*M. grandis* Roewer 1910	China, Japan, Korea and Far East Russia	Tsurusaki et al. (2005)
	2	*M. guttata* Karsch 1881	Japan	Roewer (1955)
	3	*M. ovata* Sato & Suzuki 1938	Japan (Nagano-ken)	Sato & Suzuki (1938)
	4	*M. satoi* Roewer 1955	Japan (bei Jokohama)	Roewer (1955); Suzuki (1986)
	5	*M. wangi* Zhu & Song 1999	China (Hunan Province)	Zhu & Song (1999)
	6	*M. zhui* new species	China (Hunan Province)	this paper
Indo-Malaya region	1	*M. matherania* Roewer 1915	Dekan (Matheran)	Roewer (1955)
	2	*M. rugosa* Roewer 1955	Dekan (Ootokamund)	Roewer (1955)
	3	*M. trochanteralis* Roewer 1955	Nilgiris	Roewer (1955)
	4	*M. fragilis* (With 1903)	Sikkim, Darjiling, Burma, Pashok, Himalaya, Kurseong, Pashok, Dawna Hills, Ghumti	Roewer (1955)
	5	*M. atrata* (Stoliczka 1868)	Bengalen, Himalaya, Calcutta, Bengalen	Roewer (1955)
	6	*M. varians* (With 1903)	Bengalen, Burma	Roewer (1955)
	7	*M. hansenii* (With 1903)	Vorderindien (Todaspoor)	Roewer (1955)
	8	*M. hirta* (With 1903)	Punkabari, Darjiling	Roewer (1955)
	9	*M. transversalis* Roewer 1912	Punkabari, Darjiling	Roewer (1955)
	10	*M. plebeja* Thorell 1889	Burma (Prome, Minkla)	Roewer (1955)
	11	*M. tristis* Thorell 1889	Burma (Teinzo)	Roewer (1955)
	12	*M. unicolor* Roewer 1912	Orissa, Nepal, Dawna Hills	Roewer (1955)
	13	*M. nigra* Roewer 1955	Burma (Mt. Victoria)	Roewer (1955)
	14	*M. laciniipes* Roewer 1955	Burma (Kambaiti)	Roewer (1955)
	15	*M. peguana* Roewer 1955	Burma (Pegu)	Roewer (1955)
	16	*M. dihita* Roewer 1929	Shan States (Forest of Elephant Hill), Burma (Kambaiti)	Roewer (1955)
	17	*M. impressata* Roewer 1955	Shan States	Roewer (1955)
	18	*M. asperula* Roewer 1955	Shan States	Roewer (1955)
	19	*M. yunnanensis* Roewer 1910	China (Yunnan Province)	Roewer (1955)
	20	*M. similaris* Roewer 1955	China (Yunnan Province)	Roewer (1955)
	21	*M. scabra* Roewer 1912	Tongking, Shan States, Indochina (Khusi Tao), Burma (Pegu)	Roewer (1955)
	22	*M. vittata* Roewer 1910	Sumatra (Padang Distr.)	Roewer (1955)
	23	*M. thienemanni* Roewer 1931	Bali (Kintamani)	Roewer (1955)
	24	*M. cinctipes* Banks 1930	Borneo (Mt. Murud)	Roewer (1955)
	25	*M. nigripes* Banks 1930	Borneo (Mt. Murud)	Roewer (1955)
	26	*M. maculipes* Banks 1930	Borneo (Mt. Murud)	Roewer (1955)
	27	*M. sumatrana* Suzuki 1982	Sumatra	Suzuki (1982)

significant difference concerns the penis. In *M. wangi* and *M. satoi,* the penile shafts have concave sides, while in *M. wangi* the end of the glans is truncated, and in *M. satoi* the end of the glans is tapered (Suzuki 1986: 33, fig. 42B). In *M. grandis* and *M. zhui*, the shafts have parallel sides and are flattened ventrally, while in *M. grandis* the shaft arches dorsally, and in *M. zhui* the shaft is concave dorsally.

Molecular data indicate that *Melanopa grandis* is closely related phylogenetically to *Psathyropus* L. Koeh 1878, *Systenocentrus* Simon 1886, *Marthana* Thorell 1891, and *Gagrellula* Roewer 1910 (Hedin et al. 2012), and these taxa resemble each other in external morphology. However, they are quite different in penile morphology: while Palearctic *Melanopa* laek an alate part (sac), other Palearctic gagrellines (mostly Japanese gagrellines, e.g., *Psathyropus*, *Systenocentrus*, and *Gagrellula*) have a conspicuous alate part (Martens 1987:91, Figs. 1a, b). These morphologies are known as "lanceolate" and "sacculate" in Leiobuninae Bank 1893 (McGhee 1970, 1977). Some other species of sclerosomatids have lanceolate penes; e.g., *Leiobunum calcar* (Wood 1868), *L. vittatum* (Say 1821) (Leiobuninae) (Hedin et al. 2012), and *Homalenotus quadridentatus* (Cuvier 1795) (Sclerosomatinae Simon 1879) (Martens 1978:378–380, Figs. 729, 730). These species do not seem to be closely related to the Palearctic *Melanopa*.

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